

COURSE NUMBER: FHWA-NHI-132012

COURSE TITLE: Soils and Foundations Workshop

The sponsoring organization is responsible for providing access to a materials laboratory for demonstration purposes. Course runs from 1:00 PM on Monday through noon on Friday.

This course is geared toward the practicing design and construction engineers in the foundation field, routinely dealing with soil and foundation problems, and who have little theoretical background in soil mechanics or foundation engineering. The course takes a project-oriented approach whereby the soils input to a fictitious bridge project is followed from conception to completion. A visit to a laboratory is used to illustrate basic soil concepts in typical major project phases. In each phase of the fictitious project, the soil concepts will be developed into specific foundation designs and recommendations. Classroom presentation includes a variety of exercises to verify achievement of learning objectives. Each participant will take away a notebook containing a complete foundation design, completed exercises, and enough reference data to independently complete other related activities.

OUTCOMES:

Upon completion of the course, participants will be able to:

- Develop a visual description of soils native to the host state
- List the basic soil test procedures and application of soil test results to highway projects
- Demonstrate basic procedures used for both settlement and stability analysis, and identify design solutions to stability and settlement problems
- Demonstrate procedures used for determining bearing capacity and settlement of spread footing foundations
- Demonstrate basic skill in the design and construction management of driven pile foundations
- Identify driven pile foundation construction equipment and procedures for construction inspection
- Identify format and provide minimum content for an adequate foundation report

TARGET AUDIENCE:

Geotechnical specialists, bridge designers, highway designers, construction engineers, maintenance engineers and drillers, and especially the first-line supervisors involved in the design of highway structures and earthworks. The greatest impact will be achieved by convincing structural, design, and construction engineers to use procedures from this course as a guide for routine geotechnical work. One of the major benefits is to give engineers an appreciation of activities outside their specialties that influence, or are influenced by, the work of the geotechnical specialist. All attendees should be encouraged to attend the entire course. The one exception is for drillers who could be invited to attend only the first phase of the course (Monday PM and Tuesday AM).

FEE: \$530 Per Participant

LENGTH: 4.0 Days (CEU: 2.4 Units)

CLASS SIZE: Minimum: 20; Maximum: 30

NHI Training Program Manager: Larry Jones • (703) 235-0523 • larry.jones@fhwa.dot.gov

Technical Information: Ben Rivers • (404) 562-3926 • benjamin.rivers@fhwa.dot.gov

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COURSE NUMBER: FHWA-NHI-132013 (1-Day)
 FHWA-NHI-132013A (3-Day)
COURSE TITLE: Geosynthetics Engineering Workshop

Two courses are available. These courses provide training on the correct, cost-effective utilization of geosynthetics in transportation applications. The use of geotextiles, geogrids, pavement edge drains, drainage composites, erosion control materials, sediment control materials, and geomembranes are examined. Applications of filtration, drainage, temporary and permanent erosion control, sediment control, roadway separation, roadway reinforcement, roadway subgrade improvement, pavement overlays, embankments over soft foundations, mechanically stabilized earth walls, mechanically stabilized earth slopes, geomembrane containment ponds, and geomembrane pavement encapsulation are covered.

The 1-day summary course provides an introduction to geosynthetics, focusing on identifying, specifying, testing, installing, and inspecting geosynthetic installations.

The 3-day design and construction course provides a review of design procedures, expands on the material of the one-day summary course and includes workshop problems and student exercises.

OUTCOMES:

Upon completion of the course, participants will be able to:

- Determine if geosynthetics are a feasible, cost-effective option for construction or maintenance of transportation earthworks
- Specify procedures for and oversee geosynthetic installations
- Locate references on geosynthetic materials and geosynthetic applications
- Prepare conceptual and basic designs for filtration, drainage, temporary and permanent erosion control, sediment control, roadways, pavement overlays, embankments over soft foundations, mechanically stabilized earth walls and earth slopes, and geomembrane transportation applications [3-day only]
- Select appropriate material property and design parameter test methods for specific geosynthetic projects, and differentiate between index and performance tests/properties [3-day only]
- Develop appropriate materials and construction specifications for geosynthetic projects [3-day only]
- Determine the need for site specific monitoring or special inspection schemes to ensure compliance with design [3-day only]

TARGET AUDIENCE:

Public agency personnel and consultants (bridge, hydraulic, pavement, geotechnical, construction and maintenance engineers, and construction inspectors and technicians). The 1-day course is for those involved with construction and maintenance of transportation facilities that include earthwork construction, while the 3-day course is for those involved with design and/or construction of transportation facilities that incorporate earthwork. There are no prerequisites, although prior attendance in FHWA-NHI-132012 Soils and Foundations Workshop is recommended.

FEE: \$200 Per Participant (FHWA-NHI-132013)

LENGTH: 1.0 Days (CEU: 0.6 Units)

FEE: \$400 Per Participant (FHWA-NHI-132013A)

LENGTH: 3.0 Days (CEU: 1.8 Units)

CLASS SIZE: Minimum: 20; Maximum: 30

NHI Training Program Manager: Larry Jones • (703) 235-0523 • larry.jones@fhwa.dot.gov

Technical Information: Jerry DiMaggio • (202) 366-1569 • jerry.dimaggio@fhwa.dot.gov

Technical Information: Rich Barrows • (360) 619-7704 • rich.barrows@fhwa.dot.gov



This course has different course length options. Visit the NHI Web site for information on each course length.

COURSE NUMBER: FHWA-NHI-132014**COURSE TITLE:** Drilled Shafts

Drilled shafts are an alternate type of deep foundation that may be more cost-effective than, and have improved performance compared to, other types of deep foundations in bridge piers at river crossings, retrofit operations, high-mast lighting, earth retaining structures, single-column piers, and similar applications. This course provides participants with specific technical guidance on all aspects of designing, installing, and monitoring of drilled shafts. The lessons address the following topics: applications, advantages, and disadvantages of drilled shafts for transportation structure foundations; general requirements for subsurface investigations; construction methods; construction case histories; construction specifications; principles of design of drilled shafts for axial and lateral loading; expansive soils, downdrag, and similar effects; load testing; inspection; integrity testing; repair and retrofit of defective shafts; and cost estimation. The participants will receive a comprehensive reference manual on drilled shaft construction and design used by engineers who perform detailed designs of drilled shafts, write construction specifications, and evaluate the performance of the contractor through a comprehensive inspection program.

OUTCOMES:

Upon completion of the course, participants will be able to:

- Describe the various drilling rigs and tools that are available to construct drilled shafts under varied subsurface soil and rock conditions
- Recognize the basic features of drilling aids, such as casings and drilling slurries, and the reasons for certain fundamental requirements for these aids
- Design drilled shafts for axial loading in simple soil and rock profiles
- Demonstrate a general understanding of the elements of designing drilled shafts for lateral loads
- Demonstrate an understanding of the need for load tests and available methods for performing them
- Formulate the basic elements of construction specifications for drilled shafts
- Estimate costs for drilled shafts

TARGET AUDIENCE:

Geotechnical engineers, bridge designers, and resident engineers. The course embraces both construction and design, and it is important that all participants attend all lessons, not just those in the immediate area of interest. A key issue is how the details of construction affect the way in which a drilled shaft should be designed and how the intent of the design affects inspection. Participants in the course are expected to have a degree in engineering for which they have passed an undergraduate course in soil mechanics and/or have successfully completed NHI course FHWA-NHI-132012 Soils and Foundations Workshop. This course is intended for field or laboratory personnel with a background in engineering.

FEE: \$400 Per Participant

LENGTH: 3.0 Days (CEU: 1.8 Units)

CLASS SIZE: Minimum: 20; Maximum: 30

NHI Training Program Manager: Larry Jones • (703) 235-0523 • larry.jones@fhwa.dot.gov

Technical Information: Barry Siel • (720) 963-3208 • barry.siel@fhwa.dot.gov

Technical Information: Curtis Monk • (515) 233-7320 • curtis.monk@fhwa.dot.gov



Need to find a FHWA Division or State Highway Agency contact? See the contact list on page 183.

COURSE NUMBER: FHWA-NHI-132021
COURSE TITLE: Driven Pile Foundations - Design and Construction



This course covers the practical application of driven pile technology, with an emphasis on data interpretation and decision-making issues common to real-life construction projects. The course addresses subsurface investigation, pile selection, economic analysis, static design analysis (single pile and pile group behavior under compression, tension and lateral loading, pile settlement, negative skin friction) specifications and contracting documents, construction monitoring (pile inspection, dynamic driving formulas, wave equation analysis, dynamic testing), static methods of pile load testing, driven pile installation equipment, and accessories. This course also covers definition and design procedures of aggressive subsurface conditions; the driven computer program for calculation of static pile capacity; design procedures for downdrag, scour, squeeze, and heave; plugging of open pile sections; group design for lateral and uplift loads; and economics of pile selection. Instructional methods include workshops, student exercises, and sample problems to transfer the necessary knowledge and skills to plan and design driven pile foundation projects, and to implement QA/QC procedures during construction.

OUTCOMES:

Upon completion of the course, participants will be able to:

- Implement a systematic plan for the design and construction of driven pile foundations
- Choose the appropriate pile type in a given soil profile based on the advantages and disadvantages of common driven pile types
- Calculate single and group capacities of driven piles to resist compression, tension, and lateral loads
- Use time-dependent soil strength changes in pile foundation design and construction control
- Identify the project influence and significance of pile driveability, pile refusal, and minimum and estimated pile toe elevations
- Calculate allowable design and allowable driving stresses for common pile types
- Identify pile hammer types, their operational characteristics, and key pile hammer and pile hammer accessory inspection issues

TARGET AUDIENCE:

Geotechnical specialists, bridge engineers, construction engineers, and consultant review specialists. This course is suitable for attendance by entry-level and experienced engineers and advanced-level technicians. Attendees should have a basic knowledge of subsurface investigation methods and the general aspects of foundation design and construction.

FEE: \$530 Per Participant

LENGTH: 4.0 Days (CEU: 2.4 Units)

CLASS SIZE: Minimum: 20; Maximum: 30

NHI Training Program Manager: Larry Jones • (703) 235-0523 • larry.jones@fhwa.dot.gov

Technical Information: Jerry DiMaggio • (202) 366-1569 • jerry.dimaggio@fhwa.dot.gov

Any transportation organization can host a course.
For hosting instructions, see page 7.



COURSE NUMBER: FHWA-NHI-132022

COURSE TITLE: Driven Pile Foundations - Construction Monitoring

UPDATED
COURSE

This course provides information on current methods of driven pile technology with emphasis on data interpretation and decision-making issues common to driven pile installation and monitoring. The course covers the following areas: specifications, contracting issues, pile installation, monitoring, and inspection. Application and interpretation of the wave equation, and dynamic and static pile-load-testing methods are highlighted with an emphasis on the practical issues related to pile monitoring and acceptance on typical construction projects. Construction material includes pile capacity verification by formula, wave equation, dynamic test or static test; performance and interpretation of compression, tension, and lateral load test; new load testing devices, the Osterberg Cell and Statnamic; operation and inspection of pile hammers, including new hydraulic hammers; and troubleshooting of pile hammer operation and pile installation problems. (Refer to course FHWA-NHI-132021 Driven Pile Foundations - Design and Construction for additional background information.) The goal of this course is to transfer the necessary knowledge and skills to plan driven pile foundation projects and to implement QA/QC procedures during construction.

OUTCOMES:

Upon completion of the course, participants will be able to:

- Implement a systematic plan for the construction of driven pile foundations
- Discuss the appropriate pile type in a given soil profile based on the advantages and disadvantages of common driven pile types
- Identify pile refusal, and minimum and estimated pile toe elevations
- Define key components of driven pile specifications
- Use dynamic pile testing and static load testing correctly and effectively
- Identify pile hammer types, their operational characteristics, and key pile hammer and pile hammer accessory inspection issues
- Identify pile toe accessories, pile splicing methods, and pile installation aids applicable to the pile type and subsurface conditions
- Explain appropriate methods of pile installation inspection

TARGET AUDIENCE:

Geotechnical specialists, bridge engineers, construction engineers, consultant review specialists, and advanced-level technicians involved in and responsible for the specification and construction monitoring of driven pile foundations. Basic knowledge of subsurface investigation methods is desirable.

FEE: \$270 Per Participant

LENGTH: 2.0 Days (CEU: 1.2 Units)

CLASS SIZE: Minimum: 20; Maximum: 30

NHI Training Program Manager: Larry Jones • (703) 235-0523 • larry.jones@fhwa.dot.gov

Technical Information: Jerry DiMaggio • (202) 366-1569 • jerry.dimaggio@fhwa.dot.gov



Are you hosting a course? See page 9 for a course coordination checklist.

COURSE NUMBER: FHWA-NHI-132031

COURSE TITLE: Subsurface Investigations

This course is designed to have students recognize the essential importance of a properly planned, reviewed, and executed subsurface investigation program to the design and construction of transportation facilities and to provide them with the skills to do this work. This course presents the latest methods and procedures in the planning, execution, and interpretation of the various subsurface investigation methods and the development of appropriate soil and rock design and construction parameters for engineering applications. Topics include the geotechnical specialist's role in subsurface investigations; exploration methodologies; exploratory equipment types and their suitability for various subsurface conditions; the use of in-situ testing and geophysical surveys for subsurface characterization; the handling, transportation, and storage of soil and rock samples; and laboratory testing techniques and interpretation of data. Contracting for soil and rock investigations, correlation of soil and rock properties, and preparation of clear and concise geotechnical reports are also covered. Classroom instruction includes student exercises and example problems to reinforce course OUTCOMES:.

OUTCOMES:

Upon completion of the course, participants will be able to:

- Recognize the importance of performing an adequate subsurface investigation
- Plan and execute a subsurface exploration program for a typical surface transportation project
- Use existing information in the planning of the investigation program
- Apply appropriate in-situ testing procedures based upon the expected subsurface conditions and obtain high-quality soil and rock samples for laboratory testing
- Assign appropriate laboratory testing procedures for determining soil and rock design parameters
- Interpret the results of laboratory tests and determine soil and rock parameters to be used in design
- Summarize results of subsurface investigation in a concise geotechnical investigation report

TARGET AUDIENCE:

FHWA, State, and local transportation agency employees, college and university faculty, and consultant engineers who are or will be involved in the planning, execution, review, and interpretation of subsurface investigations. An undergraduate degree in geology, engineering geology, civil engineering, or equivalent engineering experience in the highway/transportation field is desirable.

FEE: \$400 Per Participant

LENGTH: 3.0 Days (CEU: 1.8 Units)

CLASS SIZE: Minimum: 20; Maximum: 30

NHI Training Program Manager: Larry Jones • (703) 235-0523 • larry.jones@fhwa.dot.gov

Technical Information: Ben Rivers • (404) 562-3926 • benjamin.rivers@fhwa.dot.gov

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COURSE NUMBER: FHWA-NHI-132033

COURSE TITLE: Soil Slope and Embankment Design and Construction



Participants will receive a comprehensive reference manual on investigation, design, construction, and mitigation of soil slopes and embankments used by practicing highway/geotechnical engineers. The participant workbook contains copies of visual aids and student exercises that closely follow the PowerPoint slide presentations. The student exercises promote interaction in the classroom and illustrate the basic principles and analyses.

This course covers important aspects associated with the design and construction of soil slopes and embankments. It is intended to provide transportation earthwork professionals with knowledge to recognize potential soil slope/embankment stability and deformation problems in transportation projects, to develop necessary skills to design and evaluate soil slopes and embankments, and to consider the construction and inspection implications. The course embraces both design and construction. It is important for all participants to attend all lessons, not just those in their immediate areas of interest.

OUTCOMES:

Upon completion of the course, participants will be able to:

- Recognize potential failure modes or deformation types for soil slopes and embankments
- Identify the potential failure modes for soil slopes and the type of analysis required to evaluate stability of the slope
- Determine the stability of a slope using slope stability charts
- Recognize the major design consideration for embankments constructed using earth fill, rock fill, and lightweight fill
- List the design steps necessary for the design of an embankment over compressible foundation soil
- List the common causes/triggering mechanisms for landslides/slope instabilities
- List appropriate stabilization methods

TARGET AUDIENCE:

FHWA, State, and local highway agency employees, college and university faculty, and consultant engineers/geologists who are involved in the analysis, design, construction, maintenance, and remediation of soil slopes and embankments on surface transportation facilities. An undergraduate degree in civil engineering or equivalent engineering experience in the highway/transportation field is desirable.

FEE: \$335 Per Participant

LENGTH: 2.5 Days (CEU: 1.5 Units)

CLASS SIZE: Minimum: 20; Maximum: 30

NHI Training Program Manager: Larry Jones • (703) 235-0523 • larry.jones@fhwa.dot.gov

Technical Information: Peter Osborn • (410) 962-0702 • peter.osborn@fhwa.dot.gov

Technical Information: Jerry DiMaggio • (202) 366-1569 • jerry.dimaggio@fhwa.dot.gov

Learn online with NHI Internet-based courses.



COURSE NUMBER: FHWA-NHI-132034

COURSE TITLE: Ground Improvement Techniques

This course covers important design and construction aspects associated with ground improvement techniques. Topics on ground improvement techniques include grouting, vertical drains, stone columns, lightweight fills, vibro compaction, dynamic compaction, deep soil mixing, column supported embankments, soil nailing, MSE walls, and reinforced soil slopes.

The goal of this course is to have each participant recognize the applicability of, and develop preliminary cost analysis for, specific ground improvement method(s) that could be employed to sufficiently improve the ground to permit construction of earthwork, bridge and earth retaining structure transportation features.

Participants completing this course will develop an appreciation for the necessary subsurface exploration and laboratory characterization necessary of subsurface soil and rock as well as the requisite design parameters necessary to develop a preliminary design and cost estimate. Limitations of each method are discussed and summarized. The course is designed so that maximum input will be elicited from the students, particularly regarding an understanding of application criteria, the impact of geotechnical features on the long-term performance, and contracting methods.

OUTCOMES:

Upon completion of the course, participants will be able to:

- Locate criteria to determine the applicability of each ground improvement method for a specific project under consideration
- Describe advantages, disadvantages, and limitations for each ground improvement method discussed
- Locate and identify required soil and rock properties necessary to perform preliminary design
- Prepare conceptual and basic designs, and be able to check contractor-submitted designs
- Discuss appropriate QA/QC methods for each type of ground improvement method
- Summarize key elements of a preferred contracting method for each technique
- Develop a preliminary cost estimate based on a preliminary design

TARGET AUDIENCE:

FHWA, State, and local highway agency employees, college and university faculty, and consultant engineers who are or will be involved in planning, designing, and/or constructing ground improvement systems for earthwork, bridge, and earth retaining structure transportation features. An undergraduate degree in geology, engineering geology, civil engineering, or equivalent engineering experience in the highway/transportation field is desirable.

FEE: \$400 Per Participant

LENGTH: 3.0 Days (CEU: 1.8 Units)

CLASS SIZE: Minimum: 20; Maximum: 30

NHI Training Program Manager: Larry Jones • (703) 235-0523 • larry.jones@fhwa.dot.gov

Technical Information: Silas Nichols • (410) 962-1246 • silas.nichols@fhwa.dot.gov



See page 180 to learn about distance learning.

COURSE NUMBER: FHWA-NHI-132035

COURSE TITLE: Rock Slopes



The participants will receive a comprehensive reference manual (FHWA-HI-99-007) and the accompanying student exercises (FHWA-HI-99-036). The reference manual is a comprehensive reference on investigation, design, and construction of rock slopes for highway/geotechnical engineers. It is geared to the practicing engineer who is involved with rock slope design and stabilization, but may not have the complete theoretical background. The student exercises (FHWA HI-99-036) are designed to promote interaction in the classroom and to illustrate the basic principles and analyses. Solutions to the exercises are included with each exercise.

The course presents appropriate geological investigation techniques, shear strength theories and determination of rock strength, and various design methods for rock slopes with different failure mechanisms. Other topics include rock blasting, rock slope stabilization methods, and contracting issues. Classroom instructions include the discussion of sample problems and case histories involving rock slope analyses and design.

OUTCOMES:

Upon completion of the course, participants will be able to:

- Describe the basic principles of rock slope design
- Plan and execute a geological investigation, including geologic mapping
- Perform appropriate in-situ and laboratory strength tests
- Determine rational design rock strength parameters by proper evaluation of in-situ and laboratory test data along with appropriate rock strength correlations
- Identify the failure mechanisms associated with rock slopes and apply appropriate design methodologies
- Design effective rock-fall protection and slope stabilization measures
- Design a monitoring program for cut slopes

TARGET AUDIENCE:

FHWA, State, and local highway agency employees, college and university faculty, and consultant engineers/geologists who are or will be involved in the design, excavation, and stabilization of rock slopes. An undergraduate degree in geology, engineering geology, civil engineering, or equivalent engineering experience in the highway/transportation field is desirable.

FEE: \$270 Per Participant

LENGTH: 2.0 Days (CEU: 1.2 Units)

CLASS SIZE: Minimum: 20; Maximum: 30

NHI Training Program Manager: Larry Jones • (703) 235-0523 • larry.jones@fhwa.dot.gov

Technical Information: Barry Siel • (720) 963-3208 • barry.siel@fhwa.dot.gov

FHWA Mission – Enhancing mobility through
innovation, leadership, and public service.



COURSE NUMBER: FHWA-NHI-132036

COURSE TITLE: Earth Retaining Structures



The goal of this course is to provide agencies with state-of-the-practice design tools and construction techniques to expand implementation of safe and cost-effective earth retention technologies. This course addresses the selection, design, construction, and performance of earth retaining structures used for support of fills and excavations or cut slopes. Factors that affect wall selection are discussed, including contracting approaches with an emphasis on required bidding documents for each approach. Class discussions will include design procedures and case histories, demonstrating the selection, design, and performance of various earth retaining structures.

OUTCOMES:

Upon completion of the course, participants will be able to:

- Recognize potential applications for retention structures used in transportation facilities
- Select the most technically appropriate and cost-effective type of retaining wall for the application from a thorough knowledge of available systems
- Examine and select appropriate material properties, soil design parameters, and earth pressure diagrams
- Prepare conceptual and basic (i.e., for simple geometry) designs using appropriate design methods, factors of safety, earth pressure diagrams and field verification methods; and be able to appraise contractor-submitted designs
- Select appropriate specification/contracting method(s) and prepare contract documents
- Demonstrate a clear understanding of retaining wall construction and maintenance

TARGET AUDIENCE:

Primary audience is agency and consultant bridge/structures, geotechnical, and roadway design engineers; engineering geologists; and consultant review specialists. Additionally, management, specification and contracting specialists, and construction engineers involved in design and contracting aspects of retaining structures are encouraged to attend. Attendees should have a basic knowledge of soil mechanics and structural engineering.

FEE: \$400 Per Participant

LENGTH: 3.0 Days (CEU: 1.8 Units)

CLASS SIZE: Minimum: 20; Maximum: 30

NHI Training Program Manager: Larry Jones • (703) 235-0523 • larry.jones@fhwa.dot.gov

Technical Information: Barry Siel • (720) 963-3208 • barry.siel@fhwa.dot.gov

If you're interested in this course, you may
also want to take advantage of another
NHI geotechnical course.

130082 LRFD for Highway Bridge Substructures
and Earth Retaining Structures



COURSE NUMBER: FHWA-NHI-132037**COURSE TITLE:** Shallow Foundations

The participants will receive a comprehensive reference manual on investigation, design, and construction of shallow foundations used by highway/geotechnical engineers that will be referred to during the course, so the participants will become familiar with its contents. The student exercises book is an interactive teaching tool for the course.

This course provides transportation earthwork professionals with the necessary skills to design shallow foundations for transportation applications and to consider the construction and inspection implications on the design.

Presentation of the course is in an interactive format so that the participants are actively involved in the learning experience.

OUTCOMES:

Upon completion of the course, participants will be able to:

- Recognize potential failure modes or deformation types for soil slopes and embankments
- Develop the ability to judge when shallow foundations should be considered
- List the failure modes of shallow foundations
- Determine the bearing capacity of shallow foundations on soils and rocks
- Calculate vertical stress distribution below a shallow foundation
- Determine the primary consolidation settlement of shallow foundations on cohesive soils
- Determine the settlement of shallow foundations on cohesionless soils
- Identify problematic soils that may be encountered
- List the soil improvement techniques that may be used to improve the performance of shallow foundations
- List ground improvement techniques that may be used to improve the performance of shallow foundations
- Describe procedures for construction inspection and performance monitoring of shallow foundations

TARGET AUDIENCE:

FHWA, State, and local highway agency employees, college and university faculty, and consultant engineers/geologists who are involved in the analysis, design, construction, maintenance, and remediation of soil slopes and embankments on surface transportation facilities. An undergraduate degree in civil engineering or equivalent engineering experience in the highway/transportation field is desirable.

The course will be of most benefit to geotechnical engineers, engineering geologists, foundation designers, project engineers, and highway/bridge engineers who are involved in design and construction of foundations for surface transportation projects.

FEE: \$270 Per Participant

LENGTH: 2.0 Days (CEU: 1.2 Units)

CLASS SIZE: Minimum: 20; Maximum: 30

NHI Training Program Manager: Larry Jones • (703) 235-0523 • larry.jones@fhwa.dot.gov

Technical Information: Jerry DiMaggio • (202) 366-1569 • jerry.dimaggio@fhwa.dot.gov

COURSE NUMBER: FHWA-NHI-132040

COURSE TITLE: Geotechnical Aspects of Pavements

This course covers the latest methods and procedures to address the geotechnical issues in pavement design, construction and performance for new construction, reconstruction, and rehabilitation (e.g., road widening) pavement projects. The course content includes geotechnical exploration and characterization of in-place and constructed subgrades; designing and constructing pavement subgrades and unbound materials for paved and unpaved roads with emphasis on the current AASHTO 1993 design guidelines and on the mechanistic-empirical design approach, including the three levels of design inputs; the overall geotechnical and drainage aspects of bases, subbases and subgrades (for a safe, cost-effective, and durable pavement); and construction and inspection of pavement projects.

The goal of this course is to have each participant recognize the essential importance of the geotechnical aspects relevant to the design, construction, and performance of a pavement system. Participants completing this course will develop an appreciation for adequate subsurface exploration and laboratory characterization of subgrade soils as well as the requisite design parameters for unbound base layers and drainage features in relation to pavement design. The course is designed so that maximum input will be elicited from the students, particularly regarding an understanding of the impact of geotechnical features on the long-term performance of pavement systems.

OUTCOMES:

Upon completion of the course, participants will be able to:

- Explain the geotechnical parameters of interest in pavement design and their effect on the performance of different types of pavements
- Explain the influence of climate, moisture, and drainage on pavement performance
- Identify and explain the impact of unsuitable subgrades on pavement performance
- Determine the geotechnical inputs needed for design of pavements
- Evaluate and select appropriate remediation measures for pavement subgrades
- Explain the geotechnical aspects of construction specifications and inspection requirements
- Identify subgrade problems during construction and develop recommended solutions

TARGET AUDIENCE:

Many groups within an agency are involved with different aspects of definition, design use, and construction verification of pavement geomaterials. These groups include pavement design engineers, geotechnical engineers, specification writers, and construction engineers who are (or will be) involved in the design, evaluation, and construction (or reconstruction or rehabilitation) of pavements. This course was developed as a format for these various personnel to meet, and together develop a better understanding of the geotechnical aspects of pavements. The overall goal is for this group of personnel to work together to enhance current procedures to build and maintain more cost-efficient pavement structures.

FEE: \$400 Per Participant

LENGTH: 3.0 Days (CEU: 1.8 Units)

CLASS SIZE: Minimum: 20; Maximum: 30

NHI Training Program Manager: Larry Jones • (703) 235-0523 • larry.jones@fhwa.dot.gov

Technical Information: Jerry DiMaggio • (202) 366-1569 • jerry.dimaggio@fhwa.dot.gov



Ready to request a course? Please complete the On-Site Course Request Form (FWHA Form 1530) located in the back of the catalog or submit an electronic copy via the NHI Web site.

COURSE NUMBER: FHWA-NHI-132041

COURSE TITLE: Geotechnical Instrumentation

The course is designed to provide students with the necessary knowledge and skills to plan, select, and implement instrumentation programs in geotechnical features for construction monitoring and performance verification. The course will discuss measurement tools, including recommendations for a systematic and complete approach to planning monitoring programs. Recommendations for the selection of proper instrumentation for various types of construction are presented. Field tasks covered include calibration, maintenance and installation of instrumentation, collection of instrumentation data, processing and presentation of collected data, interpretation of processed data, and reporting of results.

OUTCOMES:

Upon completion of the course, participants will be able to:

- Recognize effective uses of geotechnical instrumentation in transportation projects
- Identify benefits of instrumentation to help participants promote instrumentation programs to their teams (ultimate benefit - save money)
- Recognize the need to follow a systematic approach when planning, selecting, and executing an instrumentation program and identify the components of a systematic approach
- Identify available instrumentation and how it is used for answering key geotechnical questions
- Identify where to find additional information and assistance
- Perform an evaluation of the need for and potential benefits of geotechnical instrumentation on a project

TARGET AUDIENCE:

FHWA, State, and local highway agency employees, college and university faculty, and consultant engineers/geologists who are or will be involved in the design, evaluation, and construction of pavements. An undergraduate degree in civil engineering, geology or equivalent engineering experience in the highway/transportation field is desirable.

FEE: \$270 Per Participant

LENGTH: 2.0 Days (CEU: 1.2 Units)

CLASS SIZE: Minimum: 20; Maximum: 30

NHI Training Program Manager: Larry Jones • (703) 235-0523 • larry.jones@fhwa.dot.gov

Technical Information: Silas Nichols • (410) 962-2460 • silas.nichols@fhwa.dot.gov



Look on the inside back cover for information about NHI's accreditation with the International Association for Continuing Education and Training (IACET).

COURSE NUMBER: FHWA-NHI-132042

COURSE TITLE: Design of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes

Mechanically stabilized earth walls (MSEW) and reinforced soil slopes (RSS) are two modern methods of earth-fill construction which are extremely cost-effective and aesthetically pleasing. The basic concept behind these related methods is to combine soil, reinforcing materials made of steel or polymers, and appropriate facing to produce a composite material with improved engineering properties. Both MSEW and RSS provide substantial construction time and cost savings when compared with other conventional types of earth-retaining systems.

The goal of this course is to provide agencies with state-of-the-practice design tools and construction practices to initiate or continue implementation of mechanically stabilized earth technology for routine use of cost-effective earth retention structures. This course would be of most benefit to persons who are involved in design and construction of earth retention structures for surface transportation projects.

OUTCOMES:

Upon completion of the course, participants will be able to:

- Recognize potential applications for MSEWs and RSS structures for use in transportation facilities
- Prepare conceptual and basic (i.e., for simple geometry) designs, and be able to check contractor-submitted designs for walls and slopes
- Examine and select appropriate material properties and parameters used in design
- Calculate cost of conceptual MSEWs and RSS structures, and determine if construction is a cost-effective option
- Select appropriate specification/contracting method(s). Prepare detailed materials and methods of construction specifications
- Define and communicate major components of construction inspection of MSEWs and RSS structures to confirm compliance with design

TARGET AUDIENCE:

Primary audience is agency and consultant bridge/structures, geotechnical, and roadway design engineers; engineering geologists; and consultant review specialists. Additionally, management, specification and contracting specialists, and construction engineers interested in design and contracting aspects of MSEW and RSS structures are encouraged to attend. Attendees should have a basic knowledge of soil mechanics and structural engineering. (Note that NHI offers a 1-day course, FHWA-NHI-132043 Construction of MSEW and RSS. The target audience for that course is construction engineers, inspectors, and technicians.)

FEE: \$400 Per Participant

LENGTH: 3.0 Days (CEU: 1.8 Units)

CLASS SIZE: Minimum: 20; Maximum: 30

NHI Training Program Manager: Larry Jones • (703) 235-0523 • larry.jones@fhwa.dot.gov

Technical Information: Rich Barrows • (360) 619-7704 • rich.barrows@fhwa.dot.gov

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COURSE NUMBER: FHWA-NHI-132043**COURSE TITLE:** Construction of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes

Mechanically stabilized earth walls (MSEW) and reinforced soil slopes (RSS) are two modern methods of earth-fill construction which are extremely cost-effective and aesthetically pleasing. The basic concept behind these related methods is to combine soil, reinforcing materials made of steel or polymers, and appropriate facing to produce a composite material with improved engineering properties. Both MSEW and RSS provide substantial construction time and cost savings when compared with other conventional types of earth-retaining systems.

The goal of this course is to provide agencies with current construction practices for continued, or to initiate, implementation of mechanically stabilized earth technology for routine use of cost-effective earth retention structures. This course is most beneficial to persons who are involved in the construction of earth retention structures for surface transportation projects.

OUTCOMES:

Upon completion of the course, participants will be able to:

- Recognize potential applications for MSEWs and RSS structures for use in transportation facilities
- Recognize differences between available systems and their components
- Understand the intent of specification/contracting method(s)
- Define and communicate major components of construction inspection of MSEW and RSS structures to confirm compliance with design

TARGET AUDIENCE:

Primary audience is agency and consultant construction engineers, inspectors, and technicians. Additionally, management; specification and contracting specialists; bridge/structures, geotechnical, and roadway design engineers; and engineering geologists interested in construction aspects of MSEW and RSS structures are encouraged to attend. Attendees should have a basic knowledge of soil mechanics and structural engineering. (Note that NHI offers a 3-day course, FHWA-NHI-132042 Design of MSEW and RSS Structures, and the target audience of that course is bridge/structures, geotechnical, and roadway design engineers; and engineering geologists.)

FEE: \$200 Per Participant

LENGTH: 1.0 Days (CEU: 0.6 Units)

CLASS SIZE: Minimum: 20; Maximum: 30

NHI Training Program Manager: Larry Jones • (703) 235-0523 • larry.jones@fhwa.dot.gov

Technical Information: Rich Barrows • (360) 619-7704 • rich.barrows@fhwa.dot.gov

If you're interested in this course, you may
also want to take advantage of another
NHI geotechnical course.

130082 LRFD for Highway Bridge Substructures
and Earth Retaining Structures



COURSE NUMBER: FHWA-NHI-132069

COURSE TITLE: Driven Pile Foundation Inspection

This course was developed to provide a basis for local, regional, or national qualification for pile driving inspectors of all States. Its goal is to provide inspectors with the practical knowledge and accepted standard industry practices for the inspection of pile-driving construction operations.

To establish a national standard for transportation personnel, this course was developed based upon the existing Florida DOT's Pile Driving Inspector's Qualification course materials, the 2000 AASHTO "Bridge Construction Specifications," and FHWA NHI courses FHWA-NHI-132021 Driven Pile Foundations - Design and Construction and FHWA-NHI-132022 Driven Pile Foundations - Construction Monitoring. However, the local specifications, inspection reports, and plan sheets available from the hosting agency also will be discussed. The course includes a three-hour qualification examination.

OUTCOMES:

Upon completion of the course, participants will be able to:

- Explain the inspector's role, duties, and responsibilities
- Describe the pile driving system components
- Recognize key inspection elements of the contract documents
- Identify proper communication and coordination with the engineer and contractor
- Identify the key elements of a pile installation plan
- Recognize and identify pile driving system components and tools
- Verify tip elevations, cutoff elevations, pile penetration, and length driven for vertical and battered piles
- Perform inspection of pile driving operations and verify compliance to construction tolerances
- Recognize "when to stop driving" based upon provided driving criteria, minimum tip or penetration and refusal guidelines.
- Verify pile condition, labeling, and marking for compliance
- Recognize and explain the difference between test piles and production piles and the various types of pile testing
- Identify "driving" irregularities
- Identify and document pay quantities
- Interpret and apply applicable AASHTO specifications relating to foundation acceptance
- List potential problems and safety issues

TARGET AUDIENCE:

Foundation or major structures inspectors involved in inspection of pile driving operations during construction. Additionally, project management and construction engineers in charge of pile driving construction inspection are encouraged to attend. Attendees should have completed courses in basic construction plan reading, basic construction math, and high school algebra.

FEE: \$335 Per Participant

LENGTH: 2.5 Days (CEU: 1.5 Units)

CLASS SIZE: Minimum: 20; Maximum: 30

NHI Training Program Manager: Larry Jones • (703) 235-0523 • larry.jones@fhwa.dot.gov

Technical Information: Peter Osborn • (410) 528-4550 • peter.osborn@fhwa.dot.gov

COURSE NUMBER: FHWA-NHI-132070

COURSE TITLE: Drilled Shaft Foundation Inspection

The Drilled Shaft Foundation Inspection course is a stand-alone training course developed to provide a basis for local, regional, or national qualification of drilled shaft foundation inspectors. The goal of this course is to provide drilled shaft foundation inspectors with practical knowledge and standard industry practices for the inspection of drilled shaft foundation construction.

Presentation of the course is in an interactive format, so that the participants are actively involved in the learning experience. A two-hour qualification exam is administered on the third day of the course.

The course follows recommended FHWA specifications and practices for drilled shaft construction. This course may be modified to follow local agency specifications and practices, which may deviate from recommended FHWA specifications and practices.

OUTCOMES:

Upon completion of the course, participants will be able to:

- Identify and understand the role and duties of the inspector
- Recognize key inspection elements of the contract documents
- Identify proper communication and coordination with the engineer and contractor
- Interpret and verify contractor compliance with drilled shaft installation plan items
- Recognize and identify drilled shaft construction equipment and tools
- Perform visual field verification of soil/rock material for comparison to supplied soil boring data/logs
- Calculate percent recovery and rock quality designation (RQD)
- Recognize and identify the various types of drilled shaft construction
- Perform inspection of drilled shaft excavations for compliance to plans, construction tolerances and cleanliness
- Verify reinforcing cage construction compliance including side spacers and SCL requirements
- Determine theoretical shaft concrete volumes and develop concrete curves
- Identify shaft "concreting" irregularities
- Perform calculations for volume, area, circumference, and elevation
- Locate, explain, and apply applicable FHWA guide specifications/AASHTO/State DOT specifications relating to compliance

TARGET AUDIENCE:

The primary audience is agency and consultant foundation or major structures inspectors. Additionally, project management and construction engineers in charge of drilled shaft construction inspection are encouraged to attend.

This course is designed to be of most benefit to foundation inspectors who are responsible for or involved in providing inspection of drilled shafts during construction.

FEE: \$335 Per Participant

LENGTH: 2.5 Days (CEU: 1.5 Units)

CLASS SIZE: Minimum: 20; Maximum: 30

NHI Training Program Manager: Larry Jones • (703) 235-0523 • larry.jones@fhwa.dot.gov

Technical Information: Peter Osborn • (410) 528-4550 • peter.osborn@fhwa.dot.gov

COURSE NUMBER: FHWA-NHI-132078 **COURSE TITLE:** Micropile Design and Construction



The primary goal of this course is to provide the target audience with guidance on when and where it is appropriate to use micropiles, and with the state-of-the-practice in the design and construction of micropiles. Stepwise procedures for the design of micropiles for structural support and for slope stability applications are presented. Construction, inspection and integrity testing aspects and issues are discussed. Classroom presentations include exercises that will lead participants through the technical and cost feasibility evaluation aspects for structural support and slope stability design with micropiles. Each participant will receive a participant workbook and micropile reference manual containing detailed micropile design examples for various applications.

FHWA-NHI-132012 Soils and Foundations Workshop is a recommended prerequisite.

OUTCOMES:

Upon completion of the course, participants will be able to:

- Briefly describe the history and current status of the micropile industry
- Identify potential micropile applications
- Explain construction constraints, techniques, and performance
- Assess feasibility of micropiles for a given application
- Prepare conceptual and basic designs, and evaluate contractor-submitted designs
- Select appropriate specification/contracting method(s) and prepare contract documents
- Describe construction monitoring and inspection requirements

TARGET AUDIENCE:

This course is directed toward practicing geotechnical, foundation, construction and bridge/structural engineers who have knowledge and experience in the design and construction of driven piles and drilled shaft foundations. Engineers involved with the design and construction of structure foundations will all benefit from this training that builds upon the basic concepts presented in FHWA-NHI-132012, 132014, and 132021.

FEE: \$270 Per Participant

LENGTH: 2.0 Days (CEU: 1.2 Units)

CLASS SIZE: Minimum: 20; Maximum: 30

NHI Training Program Manager: Larry Jones • (703) 235-0523 • larry.jones@fhwa.dot.gov

Technical Information: Barry Siel • (720) 963-3208 • barry.siel@fhwa.dot.gov

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COURSE NUMBER: FHWA-NHI-132079
COURSE TITLE: Subsurface Investigation Qualification



This course is part of a series to develop a training and qualification/certification program for geotechnical field inspectors. The course follows FHWA specifications and practices for subsurface investigations. A partial list of topics addressed in the course are exploration equipment and methods; safety; borehole sealing; drilling and sampling requirements and criteria; proper soil and rock visual classification and descriptions; common drilling errors; and dealing with difficult subsurface site conditions. A two-hour qualification exam is administered at the end of the course.

OUTCOMES:

Upon completion of the course, participants will be able to:

- Explain the investigation specialist's general role, duties, and the importance of coordination and communication with field personnel and engineers
- Explain the purpose of geotechnical subsurface investigations and why adequate, consistent, and quality investigations are important
- Identify the major components of the typical subsurface investigation plan
- Identify common drilling rigs, uses, and components
- Explain the importance of accurate borehole logging and documentation
- Describe the importance of accurate groundwater investigations
- Discuss drill rig operation safety issues

TARGET AUDIENCE:

Drillers, drilling inspectors, engineers, geologists, and technicians involved in field data collection and quality assurance of subsurface investigations.

FEE: \$400 Per Participant

LENGTH: 3.0 Days (CEU: 1.8 Units)

CLASS SIZE: Minimum: 20; Maximum: 30

NHI Training Program Manager: Larry Jones • (703) 235-0523 • larry.jones@fhwa.dot.gov

Technical Information: Ben Rivers • (410) 562-3926 • benjamin.rivers@fhwa.dot.gov



See page 178 to find out more about the Universities and Grants Programs.

COURSE NUMBER: FHWA-NHI-132080

COURSE TITLE: Inspection of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes

This course is part of a series to develop a training and qualification/certification program for geotechnical field inspectors. A partial list of topics addressed in the course are MSE wall and RSS types and durability; construction methods and sequences; alignment control; methods of fill and compaction control; plans, specifications, and the geotechnical report; shop drawings; and safety. A two-hour qualification exam is administered at the end of the course.

OUTCOMES:

Upon completion of the course, participants will be able to:

- Identify basic MSE wall and RSS types and design philosophy
- Explain the role and duties of the MSE wall and RSS inspector
- Identify current construction practices for mechanically stabilized earth structure construction
- Define key inspection elements for MSE wall and RSS contract documents to assure compliance
- Explain the logical steps to ensure proper communication with the engineer and responsible field personnel

TARGET AUDIENCE:

Inspectors, engineers, geologists, and technicians involved in field data collection and quality assurance for MSE walls and RSS. Additionally, managers, specification and contracting specialists, bridge/structure, geotechnical and roadway design engineers, and engineering geologists interested in construction aspects of MSE walls and RSS structures are encouraged to attend.

FEE: \$400 Per Participant

LENGTH: 3.0 Days (CEU: 1.8 Units)

CLASS SIZE: Minimum: 20; Maximum: 30

NHI Training Program Manager: Larry Jones • (703) 235-0523 • larry.jones@fhwa.dot.gov

Technical Information: Rich Barrows • (360) 619-7704 • Rich.barrows@fhwa.dot.gov

Video conferencing technology can make instructor-led courses accessible to remote participants without changing the delivery format. Contact Debbie Gwaltney at (202) 366-9379 or debbie.gwaltney@fhwa.dot.gov for more information.

